

# Information sheet

Air

## Monitoring stack emissions from natural gas-fired power stations

*This information sheet provides a framework for consistent application and interpretation of legislation by the Department of Environment, Science and Innovation and will not be applied inflexibly to all circumstances. Individual circumstances may require an alternative application of policy. This information sheet concerns schedule 2, item 14 (electricity generation) under the Environmental Protection Regulation 2019.*

### What is the issue?

Numerous power stations are located across Queensland, generating electricity from a range of different fuels (e.g. coal, diesel, aviation fuel, natural gas). Some power stations have converted to natural gas firing (using gas turbines, gas fuelled reciprocating engines and solid fuel furnaces converted to gas firing).

Natural gas is generally considered to be a 'cleaner fuel' as it usually produces lower emissions of oxides of nitrogen (NO<sub>x</sub>) and oxides of sulfur (SO<sub>x</sub>). This is recognised in the setting of lower annual fees for natural gas-fired power stations under the Environmental Protection Regulation 2019 (EP Regulation) (an aggregate environmental score (AES) of 72 (10MW or more electrical) compared to an AES of 76 (10MW to 150MW) or 151 (more than 150MW) for any other fuel).

Natural gas-fired power stations that are environmentally relevant activities (ERAs) under the EP Regulation range in size from 10MW to 500MW or more. Each application for an environmental authority must be independently assessed against the criteria set out in the legislation; however, a benchmark is needed for the application of emission monitoring provisions for natural gas-fired power station approvals.

The scope of this information sheet is limited to continuously operating power stations (i.e. base load), rather than stations with the prime role as a stand-by or emergency station to meet peak load demands (i.e. peaking plants).

### Question 1

It has been argued that since natural gas is a 'cleaner fuel' there should be no monitoring required on the environmental authority, as there is less environmental harm being caused. However, the combustion of the fuel does result in the release of contaminants to the environment, such as carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), and organic compounds including volatile organic compounds, polyaromatic hydrocarbons, NO<sub>x</sub> and SO<sub>x</sub>. Is it still necessary and desirable to require stack monitoring for power stations that burn natural gas?

### Answer 1

As there is still a release of contaminants into the air environment, monitoring is considered necessary and desirable as it is the only means by which the Department of Environment, Science and Innovation (DESI) can assess or confirm:



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- the combustion efficiency of a power station
- the contaminant load released to the atmosphere
- the contribution to, and impacts of, the emissions on the surrounding environment.

Therefore power stations operating on natural gas should have monitoring requirements included on their environmental authority. The parameters and the frequency of monitoring will depend on factors such as the size of the power station and its location (see answer 4).

### Question 2

A number of small (10–50MW) power stations (particularly on mine sites) generate power continuously, but generate far fewer contaminants than the larger power stations (>100MW). Is it appropriate to require these power stations to perform stack monitoring?

### Answer 2

While small power stations (10–50MW) release less total contaminants, monitoring should be required to assess at least the combustion efficiency of the power station.

The parameters and the frequency of monitoring will depend on factors such as the size of the power station and its location (see answer 4).

### Question 3

A number of natural gas-fired power stations are located in remote areas (e.g. mine sites). It has been argued that no monitoring should be required given that the air emissions will not affect a local community (no sensitive receptors) or contribute greatly to the air shed load (compared with other fuel burning sources such as vehicles on mine site). Should remotely located power stations be required to monitor air emissions?

### Answer 3

While power stations in remote areas are less likely to impact on sensitive receptors, the administering authority should consider requiring monitoring to assess compliance and determine operational efficiency.

The parameters and the frequency of monitoring will depend on factors such as the size of the power station and its location (see answer 4). The environmental authority holder could consider implementing continuous monitoring as a more economical option than stack grab sampling and analysis.

### Question 4

Currently most published air quality standards relate to ambient air quality—e.g. Environmental Protection (Air) Policy 2019 and National Environmental Protection (Ambient Air Quality) Measure—and not stack emissions. If stack emission monitoring is considered necessary for natural gas-fired power stations, what parameters should be monitored and how often?

### Answer 4

When determining the frequency of monitoring DESI seeks to balance the requirement for monitoring with the emission characteristics, risk to the environment, practicalities of sampling and the costs. The following table should be considered when conditioning an environmental authority for a natural gas-fired power station. It should be noted that there has been no attempt in this information sheet to set specific release limits, as they will vary considerably depending on the design and location of the units being operated.

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SIZE POWER STATION (MW)	DETERMINANTS <sup>1</sup>	FREQUENCY <sup>2</sup>
10–100MW	Combustion efficiency <sup>3</sup> NO <sub>x</sub> <sup>4</sup> O <sub>2</sub>	After initial commissioning, plant operator to carry out internal monitoring <sup>7</sup> of the plant to ensure plant is functioning to manufacturer's specifications.
>100MW <sup>5</sup>	Combustion efficiency <sup>3</sup> NO <sub>x</sub> <sup>4</sup> CO SO <sub>x</sub> <sup>6</sup> O <sub>2</sub>	After initial commissioning, stack emission monitoring twice yearly thereafter <sup>8</sup> , or if located in a sensitive receiving environment continuous monitoring may be required.

<sup>1</sup> Monitoring should be conducted when the plant is operating at its peak (i.e. should exclude start-up and shut-down). Emission test results should be converted to standard temperature and pressure (0°C and 1atm pressure which is 273°K and 101.3kPa) and expressed as milligrams per normal cubic metre (mg/Nm<sup>3</sup>) of dry flue gas. The concentration must be converted to a reference level of 15% oxygen for nitrogen dioxide for gas turbines and 3% oxygen for gas-fired boilers.

<sup>2</sup> Not all generating units for power stations in the 10–100 MW range need to be tested each year. The number of units to be monitored will relate to the overall number of units and the period over which an individual unit will be re-tested. For example, if there were five units, it would be reasonable to have one unit tested each year—then after five years all units would have been monitored; or if there were 18 x 1MW units, it would be reasonable to require monitoring on three units each year—then after six years all units would have been tested.

<sup>3</sup> Combustion efficiencies depend on unit design and generating capacity; this information should be requested from the applicant as part of the information request.

<sup>4</sup> Information about NO<sub>x</sub> emissions should be supplied with the supporting information as NO<sub>x</sub> production will depend on the type of combustion unit used. Monitoring of this contaminant is particularly important where power stations are in close proximity to the community (due to health effects), where existing chimneys are too low and where emissions are likely to contribute to smog. There are NO<sub>x</sub> reduction technologies available for gas turbine units (e.g. low NO<sub>x</sub> burners).

<sup>5</sup> For power stations, particularly in urban situations, where there is already a high contaminant load being emitted into the air environment, consideration should be given to air modelling, ambient monitoring and mass emission source monitoring. Also where there are multiple units on a particular site, it may be more cost-effective for the environmental authority holder to install a permanent analyser than to do stack monitoring for all units.

<sup>6</sup> While the sulfur content of natural gas may be low (typically <0.5%), SO<sub>x</sub> may be an appropriate parameter to monitor for large power stations that emit substantial amounts of this contaminant. However, as the content is generally low, annual monitoring for this parameter may be adequate.

<sup>7</sup> Internal monitoring refers to the monitoring required and/or recommended to ensure efficient operation. This may include measurement of parameters such as temperature, pressure, oxygen concentration and carbon monoxide concentration.

<sup>8</sup> Twice-yearly sampling, including mass emission monitoring for NO<sub>x</sub>, is considered sufficient for these >100MW stations. However, this frequency can be varied based on local environmental conditions and should be reviewed if there is a large variation in the monitoring data submitted to the administering authority.

### Other issues to consider

Given that power station operators are required to report to the National Pollutant Inventory, this approach has tried to avoid 'doubling up' on the information/data required by regulators.

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To satisfy section 21(1) of the EP Act 'best practice environmental management' of an activity, the operator and the assessing officer should be considering the adequacy of instrumentation, internal monitoring and control of the installation, and record keeping of these parameters.

### Disclaimer:

While this document has been prepared with care it contains general information and does not profess to offer legal, professional or commercial advice. The Queensland Government accepts no liability for any external decisions or actions taken on the basis of this document. Persons external to the Department of Environment, Science and Innovation should satisfy themselves independently and by consulting their own professional advisors before embarking on any proposed course of action.

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### Version history

Version	Date	Version details
1.00	6 June 2012	Versioning first added.
2.00	15 April 2013	Updated for corporate style and the <i>Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012</i> .
3.00	11 November 2015	Changed from operational policy to information sheet. Information amended and reordered.
3.01	15 August 2016	Added version history, publication number ESR/2015/1610 and effective date.
3.02	25 June 2018	Document rebranded to align with machinery of government changes.
3.03	08 October 2019	Updated for the commencement of Environmental Protection Regulation 2019.
3.04	14 April 2022	Facsimile number removed.
3.05	16 February 2024	Document rebranded to align with machinery of government changes.